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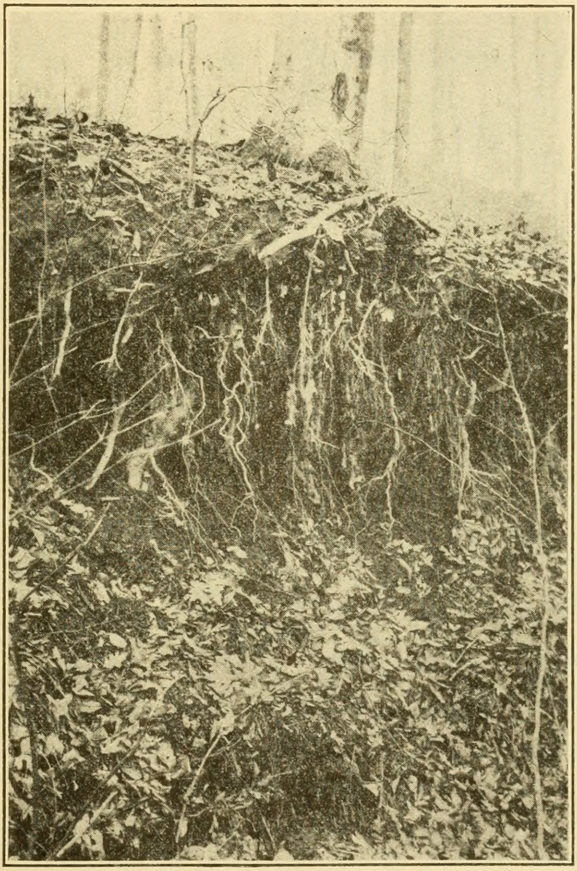
ITED STATES DEPARTMENT OF AGRICULTURE

MISCELLANEOUS PUBLICATION No. 136

WASHINGTON, D. C. JANUARY, 1932

CONSERVATION OF FERTILIZER MATERIALS FROM MINOR SOURCES



UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1932

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CONSERVATION OF FERTILIZER MATERIALS FROM MINOR SOURCES

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THE VALUE OF COMPOSTS

In maintaining soil fertility the periodic addition of organic matter plays an important part. Composts are constantly being made through the rotting of leaves, twigs, roots, and other organic matter as shown by the photograph on the title-page of this publication. Composts of various substances may help supply organic matter, and they also often supply nitrogen, phosphoric acid, potash, and other elements needed by plants. The general farmer is forced to rely principally on stable manure, commercial fertilizers, and green-manure crops, but the small farmer, or suburbanite, can often use to advantage a great variety of waste substances which are valuable as fertilizers but obtainable in such small quantities as to make them unprofitable to handle on a commercial scale. In butchering hogs on the farm the blood, entrails, and several other parts are frequently wasted. These are all valuable fertilizers. Kitchen waste, provided it is free from soap, washing powders, glass, tin cans, and other injurious materials, should be fed to animals if possible; but if no chickens or pigs are kept, it should be used in composts as fertilizer. Dry leaves, weeds, sweepings from the house and barn, coffee grounds, banana peelings, soot, and wood ashes, all have fertilizer value. These and many other materials should be saved and either applied direct to the soil or composted with manure before using.

The value of composts has been recognized for centuries in all agricultural countries, and compost heaps are conspicuous in the rural villages of European countries and are the principal means of keeping up soil fertility in China.

MAKING COMPOSTS

It is possible to make composts in various ways, but the most common way is to alternate layers of stable manure with waste and absorbent materials, such as dried leaves, peat, muck, and sod. The pile is kept moist and turned several times in order to thoroughly mix the compost. The outside of the pile may be kept covered with soil. Where possible, at least half the material used should be manure, but if this quantity can not be obtained a small amount should be used, in any event, to inoculate the heap with the bacteria of decomposition. In the principal cities dried bagged animal manures can be purchased.

Another method of composting, where hogs are available, is to keep the animals in a tight pen, the floor of which is covered with a layer of straw or leaves. Absorbent material is added as needed, and the residues of foods, weeds, and cull vegetables, together with the manure, are thoroughly mixed and trampled by the hogs. If care is used this practice will yield a large amount of valuable compost, although the procedure is not recommended from a stock-raising standpoint.

Where very fine material is desired, well-rotted compost may be screened, and the parts which are not thoroughly broken down removed. (Fig. 1.) The screened material is particularly valuable where small and delicate plants have been set out or are being cultivated. Such material may be used on lawns where the coarser material is too unsightly and gives slower results.

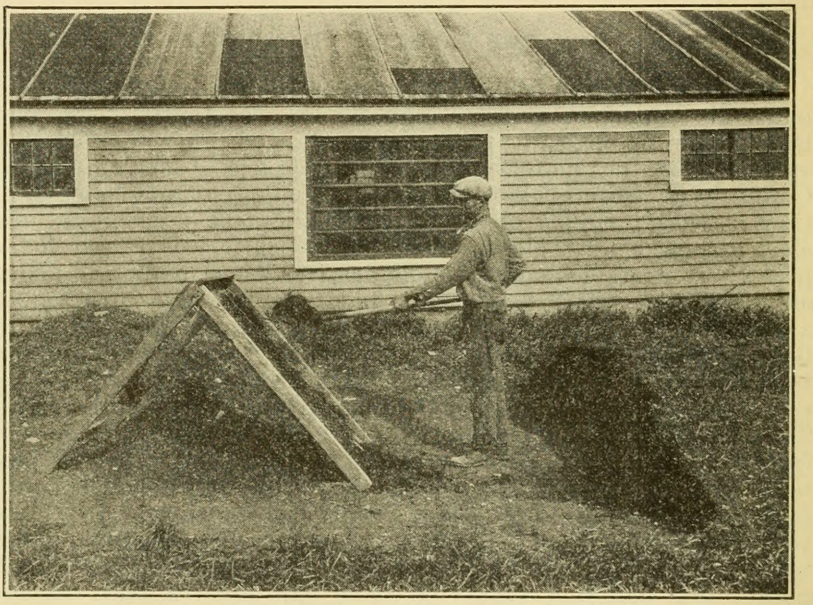

FIGURE 1.—Screening well-rotted compost for special use

THE USE OF CHEMICALS IN COMPOSTS

It is possible to use chemicals either to hasten the decomposition of the waste materials or to increase the content of any needed element in the compost. Bone meal, superphosphate, or ground phosphate rock may be added to supply phosphoric acid, and any of the potash salts to supply potash. Wood ashes are often available, and they supply not only potash but lime. Lime may be needed to reduce acidity as the proper bacteria may not act satisfactorily if the compost is too acid. It has long been recommended that chemical carriers of nitrogen be used to hasten decomposition. This thought would naturally be suggested by the use of manure. In 1873 George

F. Wilson, of the Rumford Chemical Works recommended that his "ammoniated superphosphate of lime" be used in the compost heap although it could be applied directly to the soil. The formula was as follows:

	Pounds
Dried sulphate of lime containing 4½ per cent of acid phosphate of lime	500
Crystals of sulphate of ammonia	250
Bi-phosphate of lime obtained by treating unburned bones, bone ash, bone-coal dust, and animal organic matter with an equivalent of oil of vitriol	1, 250
Total	2, 000

This formula is chiefly of historical interest. It called for material not now on the market and has been replaced by more modern formulas.

SOME PRACTICAL SUGGESTIONS

At the present time a patented chemical activator is on the market. This may be purchased, or standard fertilizer chemicals may be used. The following methods have been worked out and recommended by various experiment stations:

The Rothamsted Agricultural Experiment Station, Harpenden, England, developed a process which has been patented in the United States and elsewhere. The process consists essentially in adding to every ton of dry weight of plant refuse materials, such as straw or leaves, 100 pounds of sulphate of ammonia and 100 pounds of finely ground limestone. The straw is laid down in a layer about 1 foot thick and some of the chemicals applied, then another layer of straw or organic matter is used, followed again by chemical treatment, and this process is repeated until the pile is built up. During this operation the pile is sprinkled with water and kept moist. It is highly essential that the pile at all times be kept wet while it is undergoing the changes, and this can be accomplished more readily by making the pile concave so that it will retain the water.

It is claimed that the straw is very rapidly reduced to manure in this way (within a period of a few weeks or months), and that the material resulting has the usual properties of decomposed manure. A great shrinkage in the pile occurs during this action, owing to the fact that the bacteria which are present in the straw or leaves act immediately and vigorously under the influence of the sulphate of ammonia and finely ground limestone. An improved chemical reagent similar in its action to that just described has been patented and is now on the American market.

The New York Agricultural Experiment Station at Geneva, N. Y., recommends that to each ton of dry straw the following fertilizer materials be added:

	Pounds
Sulphate of ammonia	60
Ground limestone	50
Superphosphate	30
Muriate of potash	25
Total	165

The straw or other organic matter is spread out in a pile, layer by layer. Each 6-inch layer is treated with the chemicals. The pile is built up layer by layer until it is about 4 feet high. Each layer is wet as placed, and finally the pile is kept moist as decomposition occurs. A mixture of this character started in July was thoroughly decomposed in three months.

The Missouri Agricultural Experiment Station has used and recommends a mixture of 45 per cent ammonium sulphate, 40 per cent finely ground limestone, and 15 per cent acid phosphate. This mixture, used at the rate of 150 pounds per ton of straw, with moisture converts straw into a brown product having all the general properties of manure. The mixture may be applied to wheat straw through the thresher, thus cutting down labor costs and making the process practical under farm conditions.

The Iowa Agricultural Experiment Station used two mixtures—one of 45 per cent ammonium sulphate, 23 per cent finely ground rock phosphate, and 32 per cent finely ground limestone, and the other of 45 per cent ammonium sulphate, 15 per cent superphosphate (16 per cent grade), and 40 per cent finely ground limestone. Both these mixtures made satisfactory composts when sufficient water was added.

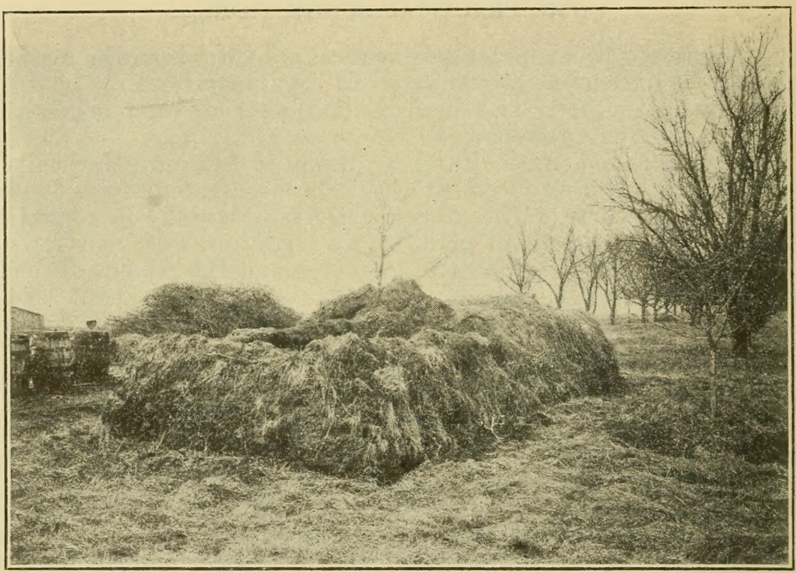

FIGURE 2.—Composting under farm conditions

It is suggested that those interested in composts should consult their State experiment station as to the work of this character done in the State and advise with the county agent regarding it. In view of the fact that patents have been taken out on certain composting processes it may be well to consult the State agricultural authorities regarding the use of these processes.

When farm conditions do not warrant the extra time and expense required to make a carefully constructed compost heap, a pile of manure and compost material can be easily made and left to weather. This will give a very useful product with a minimum of cost and labor. Such a compost pile is shown in Figure 2.

COAL ASHES AND SPOILED FEEDS

Coal ashes have little value as a fertilizer, but when sifted and mixed with heavy clay soils they make the latter more productive by loosening the soils and by the consequent improvement of moisture and tillage conditions. Wood is often used in starting coal fires, and as wood ashes contain from 5 to 10 per cent of potash this admixture tends to add to the value of the coal ashes. Soot is especially valuable for its content of nitrogen which averages 3 per cent. It should be carefully saved.

Almost all commercial feeding stuffs are good fertilizers. They are usually worth more as feeds than as fertilizers, but they often become moldy or otherwise unfit for food, and in such event, instead of being destroyed, they should be saved and applied to the soil. The feeds rich in nitrogen, such as cottonseed meal, bran, and beef scrap, are especially valuable.

ANALYSES OF VARIOUS MATERIALS

The majority of the materials of which analyses are given in the following pages are not of sufficient value to justify purchase for use as fertilizers, but they are of sufficient value to warrant composting or similar treatment on individual farms where they may be available at little or no cost.

Tables 1 and 2, compiled mainly from standard textbooks, experiment station reports, and analyses made in the laboratory of the Bureau of Chemistry and Soils, give percentages of nitrogen, phosphoric acid, and potash, and indicate the relative values of many substances that may sometimes be used to advantage as fertilizer materials. Table 1 contains a list of some of the more common fertilizer materials for comparison with a great variety of other materials listed in Table 2 which may be used for making compost.

TABLE 1.—*Percentage composition of some standard commercial materials*

Fertilizer	Nitrogen	Phosphoric acid	Potash
Ammonium sulphate	19.0–20.5		
Calcium cyanamid	19.0–22.0		
Calcium nitrate	15.0		
Nitrate of soda	15.5–16.25		
Urea	46.0		
Cottonseed meal	6.6	2.0–3.0	1.0–2.0
Dried ground fish	8.5	7.4	
Activated sewage sludge	5.0	2.75	
Dried blood	10.0–14.0	1.0–5.0	
Tankage	11.0–12.5	1.0–2.0	
Potassium nitrate	13.0		44.0
Superphosphate		16.0–20.0	
Treble superphosphate		44.0	
Ammonium phosphate	13.0	46.0	
Basic slag		17.0–18.0	
Raw ground phosphate rock		26.0–35.0	
Ground bone (raw)	2.5–4.5	20.0–25.0	
Steamed bone meal	2.5	23.0	
Potassium sulphate			48.0–52.0
Potassium chloride (muriate)			48.0–60.0
Kainit			12.0–14.0
Dried poultry manure	5.0	1.95	1.16
Dried goat manure	1.35	1.00	3.00
Dried sheep manure	1.51–3.09	.95–2.50	.33–2.24

TABLE 2.—*Percentage composition of various materials*

Material	Nitrogen	Phosphoric acid	Potash
Alfalfa hay	2.45	0.50	2.10
Apple, fruit	.05	.02	.10
Apple, leaves	1.00	.15	.35
Apple pomace	.20	.02	.15
Apple skins (ash)	----------	3.08	11.74
Ash from Cana tree	----------	----------	15.65
Banana skins (ash)	----------	3.25	41.76
Banana stalk (ash)	----------	2.34	49.40
Barley (grain)	1.75	.75	.50
Bat guano	1–12	2.5–16	----------
Beet roots	.25	.10	.50
Brewer's grains (wet)	.90	.50	.05
Brigham tea (ash)	----------	----------	5.94
Ground bone, burned	----------	34.70	----------
By-product from silk mills	8.37	1.14	.12
Cantaloupe rinds (ash)	----------	9.77	12.21
Castor-bean pomace	5– 6	2–2.5	1.0–1.25
Cattail reed and stems of waterlily	2.02	.81	3.43
Cattail seed	.98	.39	1.71
Coal ash (anthracite)	----------	.1– .15	.1– .15
Coal ash (bituminous)	----------	.4– .5	.4– .5
Cocoa-shell dust	1.04	1.49	2.71
Coffee grounds	2.08	.32	.28
Coffee grounds (dried)	1.99	.36	.67
Corncobs (ground, charred)	----------	----------	2.01
Corncob ash	----------	----------	50.00
Common crab	1.95	3.60	.20
Corn (grain)	1.65	.65	.40
Corn (green forage)	.30	.13	.33
Cottonseed	3.15	1.25	1.15
Cottonseed-hull ashes	----------	7–10	15–30
Cottonseed-hull (ash)	----------	8.70	23.93
Cotton waste from factory	1.32	.45	.36
Cowpeas, green forage	.45	.12	.45
Cowpeas, seed	3.10	1.00	1.20
Crabgrass (green)	.66	.19	.71
Cucumber skins (ash)	----------	11.28	27.20
Dog manure	1.97	9.95	.30
Dried jellyfish	4.60	----------	----------
Dried mussel mud	.72	.35	----------
Duck manure (fresh)	1.12	1.44	.49
Eggs	2.25	.40	.15
Eggshells (burned)	----------	.43	.29
Eggshells	1.19	.38	.14
Feathers	15.30	----------	----------
Field bean (seed)	4.00	1.20	1.30
Field bean (shells)	1.70	.30	.35
Fire-pit ashes from smokehouses	----------	----------	4.96
Fish scrap (red snapper and grouper)	7.76	13.00	.38
Fish scrap (fresh)	2– 7.5	1.5– 6	----------
Fresh-water mud	1.37	.26	.22
Garbage rubbish (New York City)	3.4–3.7	.1–1.47	2.25–4.25
Garbage tankage	1 –2	.5–1	.5 –1
Greasewood ashes	----------	----------	12.61
Garden beans, beans and pods	.25	.08	.30
Gluten feed	4 –5	----------	----------
Greensand	----------	1 –2	5.00
Grapes, fruit	.15	.07	.30
Grapefruit skins (ash)	----------	3.58	30.60
Hair	12 –16	----------	----------
Harbor mud	.99	.77	.05
Hoof meal and horn dust	10 –15	1.5–2	----------
Incinerator ash	.24	5.15	2.33
Kentucky bluegrass (green)	.66	.19	.71
Kentucky bluegrass (hay)	1.20	.40	1.55
King crab (dried and ground)	10.00	.26	.06
King crab (fresh)	2 –2.5	----------	----------
Leather (acidulated)	7 –8	----------	----------
Leather (ground)	10 –12	----------	----------
Leather, scrap (ash)	----------	2.16	.35
Lemon culls, California	.15	.06	.26
Lemon skins (ash)	----------	6.30	31.00
Limekiln ash	----------	.75	2.00
Do	----------	.5–1	.1–1.50
Lobster refuse	4.50	3.50	----------
Lobster shells	4.60	3.52	----------
Milk	.50	.30	.18
Mussels	.90	.12	.13
Molasses residue in manufacturing of alcohol	.70	----------	5.32
Oak leaves	.80	.35	.15
Oats, grain	2.00	.80	.60
Olive pomace	1.15	.78	1.26

TABLE 2.—*Percentage composition of various materials*—Continued

Material	Nitrogen	Phosphoric acid	Potash
Olive refuse	1. 22	0. 18	0. 32
Orange culls	. 20	. 13	. 21
Orange skins (ash)	------	2. 90	27. 00
Pea pods (ash)	------	1. 79	9. 00
Peanuts, seeds or kernels	3. 60	. 70	. 45
Peanut shells	. 80	. 15	. 50
Peanut shells (ash)	------	1. 23	6. 45
Picker dirt from cotton mill	1. 37	. 68	1. 56
Pigeon manure (fresh)	4. 19	2. 24	1. 41
Pigweed, rough	. 60	. 16	------
Pine needles	. 46	. 12	. 03
Potatoes, tubers	. 35	. 15	. 50
Potatoes, leaves, and stalks	. 60	. 15	. 45
Potato skins, raw (ash)	------	5. 18	27. 50
Poudrette	1. 46	3. 68	. 48
Powder-works waste	2–3	------	16–18
Prune refuse	. 18	. 07	. 31
Pumpkins, flesh	. 16	. 07	. 26
Pumpkin seeds	. 87	. 50	. 45
Rabbit-brush ashes	------	------	13. 04
Ragweed, great	. 76	. 26	------
Red clover, hay	2. 10	. 50	2. 00
Redtop hay	1. 20	. 35	1. 00
Residuum from raw sugar	1. 14	8. 33	------
Rockweed	1. 90	. 25	3. 68
Roses, flowers	. 30	. 10	. 40
Rhubarb, stems	. 10	. 04	. 35
Rock and mussel deposits from sea	. 22	. 09	1. 78
Sagebrush (ashes)	------	------	4. 10
Do	------	------	5. 42
Salt-marsh hay	1. 10	. 25	. 75
Salt mud	. 40	------	------
Saltpeter waste	. 52–3. 3	------	5. 6–13. 7
Sardine scrap	7. 97	7. 11	------
Seaweed (Atlantic City, N. J.)	1. 68	. 75	4. 93
Sewage sludge from filter beds	. 74	. 33	. 24
Shoddy and felt	4–12	------	------
Shoddy dirt from woolen mill	4. 40	. 20	. 68
Shrimp heads (dried)	7. 82	4. 20	------
Shrimp waste	2. 87	9. 95	------
Siftings from oyster-shell mound	. 36	10. 38	. 09
Silkworm cocoons	9. 42	1. 82	1. 08
Soot from chimney flues	. 5–11	1. 05	. 35
Spanish moss	. 60	. 10	. 55
Starfish	1. 80	. 20	. 25
String-bean strings and stems (ash)	------	4. 99	18. 03
Sunflower seed	2. 25	1. 25	. 79
Sweetpotato skins, boiled (ash)	------	3. 29	13. 89
Sweetpotatoes	. 25	. 10	. 50
Tanbark ash	------	. 24	. 38
Tanbark ash (spent)	------	1. 5–2	1. 5–2. 5
Tea grounds	4. 15	. 62	. 40
Tea-leaf ash	------	1. 60	. 44
Timothy hay	1. 25	. 55	1. 00
Tobacco leaves	4. 00	. 50	6. 00
Tobacco stalks	3. 70	. 65	4. 50
Tobacco stems	2. 50	. 90	7. 00
Tomatoes, fruit	. 20	. 07	. 35
Tomatoes, leaves	. 35	. 10	. 40
Tomatoes, stalks	. 35	. 10	. 50
Waste from hares and rabbits	7. 00	1. 7–3. 1	. 60
Waste from felt-hat factory	13. 80	------	. 98
Waste product from paint manufacture	. 028	39. 50	------
Waste gunpowder (sweepings from powder mill)	10. 28	------	34. 50
Waste silt	8–11	------	------
Wheat, bran	2. 65	2. 90	1. 60
Wheat, grain	2. 00	. 85	. 50
Wheat, straw	. 50	. 15	. 60
White clover (green)	. 50	. 20	. 30
White sage (ashes)	------	------	13. 77
Wood ashes (leached)	------	1–1. 5	1–3
Wood ashes (unleached)	------	1–2	4–10
Wool waste	5–6	2–4	1–3

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